

According to the present invention, as is clear from the above-described embodiments, a time position of a reference image is corrected by using a motion vector as required so that a plurality of pieces of reference images sampled at different times according to detected motion at certain time intervals of a block unit including at least one pixel become images at times separated from the input image by the above time intervals, so that it is possible to obtain a plurality of pieces of images at positions separated by the above time intervals from the input image. By combining the plurality of pieces of images together, a reference image of high pixel density can be obtained and a pixel value at a position which has been compensated by the detected motion is calculated by using the reference image of high pixel density, so that the calculated pixel value is used as a determined value. Thus, there is an effect that it is possible to determine motion compensation of an image at a very high level of precision.

Further, since the same value can be used for a block of each input image among blocks of a plurality of pieces of input images, each block having its whole or part of spatial position superposed with that of the other blocks, as a move detected at a certain time interval of a block unit including at least one pixel, it is not necessary to carry out a plurality of detections of moves of many block in a plurality of input images so that there is an effect that a determination of motion compensation at a high precision level can be ensured.

1. A method of determining motion compensation for an input image from motion vectors between the input image and a plurality of reference images, said method comprising the steps of:

- (a) calculating a motion vector MV1 between the input image and one reference image of said plurality of reference images [from a motion of at least one block unit] at a second set time interval T_2 between the input image and said one reference image [said at least one block unit being a part of said input image and comprising a plurality of pixels];
- (b) providing a motion vector MV2 between at least two reference images of the plurality of reference images at

(c) calculating the motion compensation of the input image from both of (i) the motion vector MV1 between the input image and said one reference image and (ii) the motion vector MV2 between the at least two reference images of the plurality of reference images.

(a) detecting a motion vector MV1 between the input image and one reference image R1 of said plurality of reference images at a second set time interval T_2 ;

(c) obtaining a motion vector MV2 between the input image and the another reference image R2 at a third set time interval T_3 from a sum of the motion vector MV1 and the motion vector MV3, and calculating respective pixels corresponding to the motion vector MV1 and the motion vector MV2 from pixels of the reference image R1 and the reference image R2 corresponding to the motion vector MV1 and the motion vector MV2 or from pixels positioned peripherally of the pixels of the reference image R1 and the reference image R2; and

(d) calculating motion-compensated pixel values from the calculated pixels of the reference images.

3. A method of obtaining a motion-compensated image from a motion vector between the motion-compensated image and a plurality of reference images, said method comprising the steps of:

- (a) obtaining a motion vector MV1 between the motion-compensated image and one reference image R1 of said plurality of reference images at a second set time interval T_2 ;
- (b) providing a motion vector MV3 between the reference image R1 and another reference image R2 of said plurality of reference images at a first set time interval T_1 , which is parallel to the motion vector MV1 and different in magnitude from the motion vector MV1 by a value determined by $MV1 \cdot T_1 / T_2$;
- (c) obtaining a motion vector MV2 between the motion-compensated image and said another reference image R2 at a third set time interval T_3 from a sum of the motion vector MV1 and the motion vector MV3, and calculating respective pixels corresponding to the motion vector MV1 and the motion vector MV2 from pixels of the reference image R1 and the reference image R2 corresponding to the motion vector MV1 and the motion vector MV2 or from pixels positioned peripherally of the pixels of the reference image R1 and the reference image R2; and
- (d) calculating motion-compensated pixel values from the calculated pixels of the reference images to obtain the motion-compensated image.

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4. A method in accordance with claim 1, wherein said motion vector MV1 between the input image and said one reference image of said plurality of reference images is calculated from a motion of at least one block unit at said second set time interval, said at least one block unit being a part of said input image and comprising a plurality of pixels.

5. A method in accordance with claim 2, wherein said motion vector MV1 between the input image and said one reference image of said plurality of reference images is calculated from a motion of at least one block unit at said second set time interval, said at least one block unit being a part of said input image and comprising a plurality of pixels.

6. A method in accordance with claim 2, wherein step (c) comprises obtaining said motion vector MV2 from a mean of said motion vector MV1 and said motion vector MV3, and said pixels positioned peripherally are valued in accordance with an average weighting inversely proportional to distance from pixels of the reference image R1 and the reference image R2.

7. A method of obtaining motion compensation for an input image, said method comprising the steps of:

(a) obtaining a first motion vector MV1 between the input image and one reference image R1 of a plurality of reference images at a second set time interval T2 between the input image and said one reference image R1;

(b) calculating a second motion vector MV2 between the input image and another reference image R2 of said plurality of reference images at a first set time interval T1 between the input image and said another reference image R2, said second motion vector MV2 being parallel to said first motion vector MV1 and having a magnitude satisfying the relation $MV2 = MV1 \cdot (T1/T2)$;

(c) calculating pixel values of said one reference image R1 from pixels at positions corresponding to said first motion vector MV1 and calculating pixel values of said another reference image R2 from pixels at positions corresponding to said second motion vector MV2, wherein said reference images R1 and R2 are such that a motion vector MV3 between said reference images R1 and R2 has a mathematical relationship with said first and second motion vectors MV1 and MV2 in which said motion vector MV3 is parallel to and different in

value from each of said first and second motion vectors MV1 and MV2; and

(d) calculating said motion compensation of said input image from said pixel values calculated in step (c).

8. A method of obtaining motion compensation for an input image, said method comprising the steps of:

(a) obtaining a first motion vector MV1 between the input image and one reference image R1 of a plurality of reference images at a second set time interval T2 between the input image and said one reference image R1;

(b) calculating a second motion vector MV2 between the input image and another reference image R2 of said plurality of reference images at a first set time interval T1 between the input image and said another reference image R2, said second motion vector MV2 being parallel to said first motion vector MV1 and having a magnitude satisfying the relation $MV2=MV1 \cdot (T1/T2)$;

(c) calculating pixel values of said one reference image R1 from pixels at positions corresponding to said first motion vector MV1 and calculating pixel values of said another reference image R2 from pixels at positions corresponding to said second motion vector MV2, wherein said reference images R1 and R2 are previous to said input image in a time sequence; and

(d) calculating said motion compensation of said input image from said pixel values calculated in step (c).

9. A method of obtaining motion compensation for an input image, said method comprising the steps of:

(a) obtaining a first motion vector MV1 between the input image and one reference image R1 of a plurality of reference images at a second set time interval T2 between the input image and said one reference image R1;

(b) calculating a second motion vector MV2 between the input image and another reference image R2 of said plurality of reference images at a first set time interval T1 between the input image and said another reference image R2, said second motion vector MV2 being parallel to said first motion vector MV1 and having a magnitude satisfying the relation $MV2=MV1 \cdot (T1/T2)$;

(c) calculating first pixel values of said one reference image R1 from pixels which are neighbors of positions corresponding to said first motion vector MV1 and calculating second pixel values of said another reference image R2 from pixels which are

neighbors of positions corresponding to said second motion vector MV2, wherein said reference images R1 and R2 are such that a motion vector MV3 between said reference images R1 and R2 has a mathematical relationship with said first and second motion vectors MV1 and MV2 in which said motion vector MV3 is parallel to and different in value from each of said first and second motion vectors MV1 and MV2; and

(d) calculating said motion compensation of said input image from said first and second pixel values calculated in step (c).

10. A method of obtaining motion compensation for an input image, said method comprising the steps of:

(a) obtaining a first motion vector MV1 between the input image and one reference image R1 of a plurality of reference images at a second set time interval T2 between the input image and said one reference image R1;

(b) calculating a second motion vector MV2 between the input image and another reference image R2 of said plurality of reference images at a first set time interval T1 between the input image and said another reference image R2, said second motion vector MV2 being parallel to said first motion vector MV1 and having a magnitude satisfying the relation $MV2=MV1 \cdot (T1/T2)$;

(c) calculating first pixel values of said one reference image R1 from pixels which are neighbors of positions corresponding to said first motion vector MV1 and calculating second pixel values of said another reference image R2 from pixels which are neighbors of positions corresponding to said second motion vector MV2, wherein said reference images R1 and R2 are previous to said input image in a time sequence; and

(d) calculating said motion compensation of said input image from said first and second pixel values calculated in step (c).

11. A method in accordance with claim 7, wherein said reference images R1 and R2 are previous to said input image in a time sequence.

12. A method in accordance with claim 9, wherein said reference images R1 and R2 are previous to said input image in a time sequence.